DROUGHT IMPACTS ON THREE SELECTED IRRIGATED AGRICULTURAL AREAS IN SOUTHERN IDAHO

by

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1977 IDAHO DROUGHT STUDY SUMMARY

Introduction

The 1977 drought in Idaho was preceded by climatic changes that were unique in terms of their severity and scope. Record low snowpack during the winter of 1976-77, ranging from 14 to 55 percent of normal maximum accumulation, led to low forecasted stream flows ranging from 10 to 63 percent of average. Actual physical drought impacts made 1977 the worst drought year in the state's history.

As the realization of the serious nature of the water shortage spread in the spring of 1977, farmers and water organizations made contingency plans to deal with the anticipated shortage, while various governmental agencies and other institutions began to develop and implement emergency plans. These plans were made under uncertainty as to the severity and duration of the drought, as well as uncertainty about the effects of proposed drought strategies. What economic losses or costs would result from the strategies? What range of drought mitigation strategies do farmers consider viable? What type of institutional constraints influence the adoption of strategies to cope with a water shortage at different levels of water management? To try to answer these questions and to determine the response and consequence of farmer response to drought, a study documenting drought responses in 1977 was proposed. When funds became available in 1979, a post audit examination of what happended during the summer of 1977 was conducted. Farmer's actions in 1977 should help our understanding of what happens during periods of water shortage, and should help in formulating policies to help minimize and mitigate the impacts of future drought.

Background

During June of 1979 farmers in three areas of southern Idaho were interviewed. (See Figure 1.) Areas were selected based on drought severity including a slight drought impact area, Bingham-Bannock counties on the Upper Snake River, a moderate drought impact area, Ada-Canyon counties on the Boise River system, and a severe drought impact area, Blaine-Lincoln counties on the Little Wood and Big Wood Rivers and along the Fish Creek and Silver Creek drainages. A total of 158 farmers were interviewed in the three areas. Table

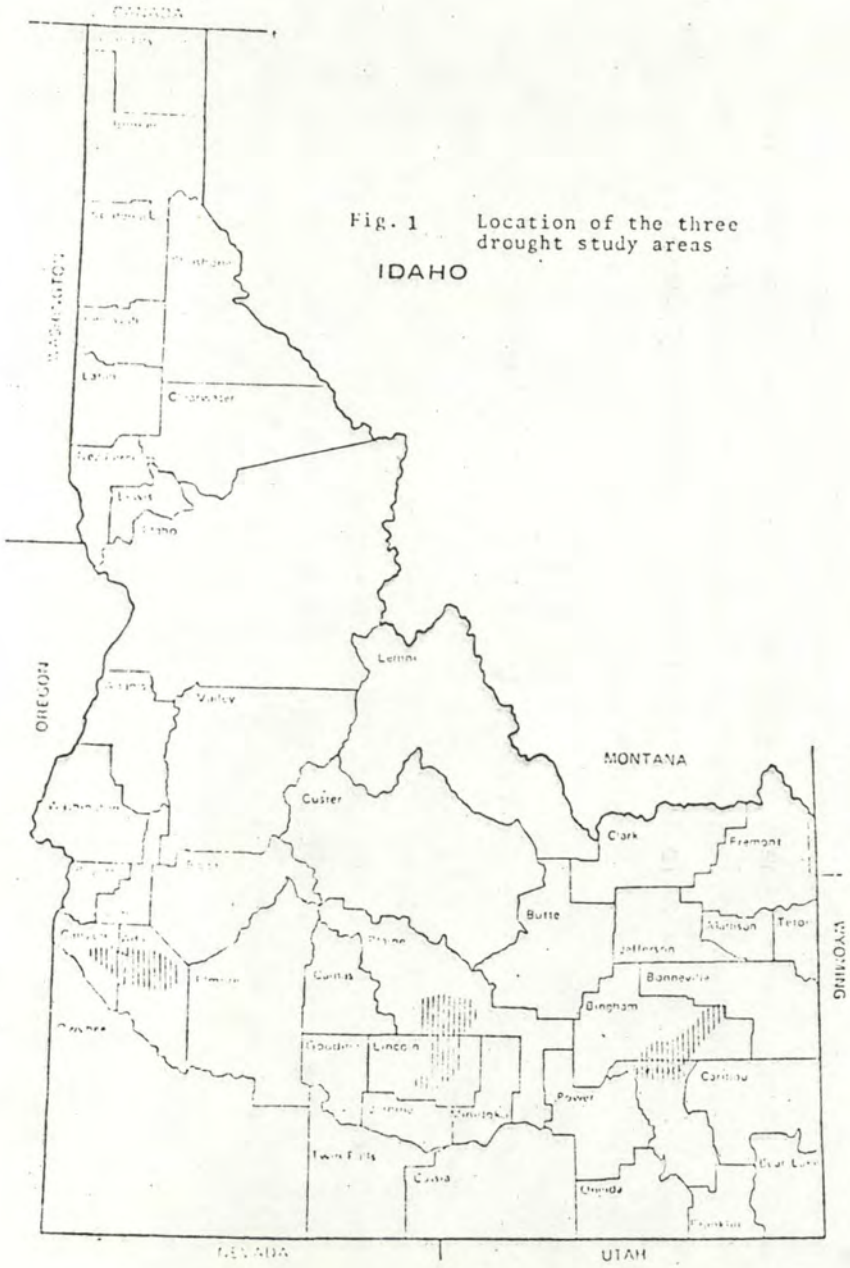

Fig. 1 Location of the three drought study areas

Table 1. Farmer Interview Sample Stratification

	Ada-Canyon Counties		Blaine-Lincoln Counties		Bingham-Bannock Counties		All Three Areas	
	#	%[1/]	#	%	#	%	#	%
Type of Crops Grown								
Hay and Grain	11	15.7	39	90.7	14	36.8	64	42.4
Cash	14	20.0	0	0.0	19	50.0	33	21.9
Perennial	29	41.4	0	0.0	0	0.0	29	19.2
Cash & Perennial	12	17.1	0	0.0	0	0.0	12	8.0
Mixed	4	5.7	4	9.3	5	13.2	13	8.6
Initial Application System								
Sprinkler	4	5.7	4	9.3	12	31.6	20	13.3
Gravity	51	72.9	21	48.8	20	52.6	92	60.9
Both	15	21.4	18	41.9	6	15.8	39	25.8
Water Source								
Surface	48	68.6	28	65.1	28	73.7	104	68.9
Both	22	31.4	15	34.9	10	26.3	47	31.1
Total Observation Used	70	100.0	43	100.0	38	100.0	151	100.0
Observations Discarded	1	-	3	-	3	-	7	-
Total Interviews Conducted	71	-	46	-	41	-	158	-

[1/] Percent of observations.

1 shows the distribution of the farmers in the three areas by the type of crop grown, the water application system, and the water source.

Along with the farm survey, 24 representatives of water delivery organizations were interviewed within the three study areas: 11 from Ada-Canyon counties, 3 from Blaine-Lincoln counties, and 10 from Bingham-Bannock counties. While the primary focus of this study was on farmer response to drought and drought impact on farmers, factors outside the direct control of farmers help determine the type of response available to farmers and must be considered. Restrictions imposed by water delivery organizations and other institutional constraints, such as Idaho's water law, can act as limiting factors to farmer's drought response.

Farmers Perception of Drought

Drought as a cause of crop loss did not rate high among farmers interviewed in Ada-Canyon or Bingham-Bannock counties even after their experience in 1977. (See Table 2.) However, farmers in severely impacted Blaine-Lincoln counties ranked drought as the most significant crop loss factor (Table 2) and were the only group in the three study areas in complete agreement that 1977 was in fact a drought year (Table 3). Secure water rights or alternative water sources protected some farmers from the effect of drought and helps explain Table 3.

Physical and Economic Impact of Drought

Early adjustments to drought and their resulting impacts illustrate the importance of a farmer's perception of the drought. These adjustments are based on the farmer's perception, which may differ from the actual drought conditions. Drought induced adjustments as well as the resulting physical and economic impacts are presented in the following pages.

Before proceeding, a word of caution is needed about possible misinterpretation of the data. Drought impacts may result directly when water shortage adversely affects crop yields, or the impact may be indirect and result from a decision by the farmer or other water manager to adjust water use in response to the drought. Any subsequent crop loss from these adjustments would result from the adjustment to drought, not from the drought itself. An explanation of how drought impacts were separated into direct

Table 2. Ranking by Farmers of Hazards Causing Crop Loss

Hazard	Ada-Canyon counties		Blaine-Lincoln counties		Bingham-Bannock counties		All three areas	
	Average rank [1]	Order [2]	Average rank	Order	Average rank	Order	Average rank	Order
Hail	3.91	4	4.63	5	4.43	6	4.24	6
Insects	2.38	1	3.08	3	2.86	2	2.70	1
Drought	4.10	5	1.93	1	4.14	4	3.50	3
Frost	3.24	2	2.29	2	2.19	1	2.71	2
Disease	3.27	3	5.01	6	4.30	5	4.02	5
Wind	4.10	5	4.04	4	3.08	2	3.83	4

[1] A lower average rank implies greater importance as a cause of crop loss.

[2] Rank ordering of hazards.

Table 3. Farmer Response to: Did you feel 1977 was a drought year?

Response	Ada-Canyon counties		Blaine-Lincoln counties		Bingham-Bannock counties		All three areas	
	#	% [1]	#	%	#	%	#	%
Yes	62	88.6	43	100.0	33	86.8	138	91.4
No	8	11.4	0	-	5	13.2	13	8.6
Total responses	70	100.0	43	100.0	38	100.0	151	100.0

[1] Percentage of all questionnaires.

drought effects and indirect adjustment effects is included in the following discussion when such a separation was possible.

Reduced Crop Yields

The primary impact from the 1977 drought was reduced crop yields. This included both direct and indirect drought impacts. Table 4 shows the 1977 crop yields for the three study areas as a percentage of the normal adjusted crop yield. Yield reductions caused by non-drought factors reported by farmers were used to adjust the normal yield so that only the drought impact was measured. Higher value cash crops in Ada-Canyon and Bingham-Bannock counties showed smaller yield reductions than lower value grain and forage crops, indicating that farmers were behaving in a rational economic manner by sacrificing lower value crops when necessary. The same was true for farmers in Blaine-Lincoln counties. However, these farmers sacrificed pasture and grain for hay needed to winter their livestock and prevent breeding stock reductions and maintained the long run integrity of their livestock enterprise.

Table 5 reports the total dollar loss and the loss per acre from reduced yields for the irrigated crops shown in Table 4 as well as the dryland. Crops shown in Table 5, as with Table 4, are those grown in 1977 that had a harvested yield, including crops and crop varieties grown only because of the drought. Relative importance of yield losses by various crops depends on the number of acres as well as the value of the crop. For example, 3,988 acres of mint in Ada-Canyon counties comprises 16.5 percent of the irrigated cropland in the area surveyed, but accounts for 36 percent of the area's total loss with $432,699 in lost value from reduced yields. By comparison, irrigated pasture occupies 1,412 acres or 5.8 percent of the irrigated cropland in the Ada-Canyon counties survey area, but accounted for only 1.4 percent of the loss from reduced crop yields with $16,492.

Acreage Adjustments

The four types of changes classed under acreage adjustments represent other options available to farmers in responding to a water shortage: 1) variety changes, 2) crop changes, 3) idled acreage, and 4) unharvested acreage. The first three are adjustments under direct control of the farmer

Table 4 Irrigated crop yields in 1977 as percentage of normal

Crop	Ada-Canyon counties			Blaine-Lincoln counties			Bingham-Bannock counties			All three areas		
	#[1]	% yield[2]	Acres[3]	#	% yield	Acres	#	% yield	Acres	#	% yield	Acres
Hay:												
Alfalfa	45	86.3	2,352	62	66.6	7,003	39	90.6	4,717	145	79.0	14,053
Other	4	92.5	101	4	73.3	165	2	90.9	112	10	84.5	378
Irrigated pasture	32	83.8	1,412	44	44.3	6,033	20	35.2	1,057	95	66.0	8,502
Green Chop	3	77.8	18	3	64.4	91	--	----	----	6	71.1	109
Wheat:												
Spring	4	83.3	310	2	68.3	51	3	95.6	680	10	84.1	41
Dryland variety	--	----	----	2	90.0	63	--	----	----	2	90.0	63
Unspecified	5	89.8	258	5	73.3	275	23	88.1	3,656	33	86.1	4,189
Barley:												
Feed	32	90.3	3,469	16	63.7	1,258	18	87.3	1,151	66	83.0	5,878
Malting	2	91.2	136	--	----	----	3	87.0	650	5	88.7	786
Dryland variety	2	94.1	50	8	72.7	605	--	----	----	10	76.9	655
Oats	8	87.3	233	4	49.0	399	5	95.0	168	17	80.5	800
Rye:												
Irrigated	1	100.0	44	--	----	----	--	----	----	1	100.0	44
Dryland variety	--	----	----	1	45.0	60	--	----	----	1	45.0	60
Mixed grain	3	86.7	115	5	61.5	169	1	97.9	68	9	73.9	352
Corn:												
Grain	5	92.5	201	--	----	----	--	----	----	5	92.5	201
Early grain	1	94.4	35	1	100.0	15	--	----	----	2	97.2	50
Silage	20	87.9	971	1	65.2	12	4	95.5	105	25	89.1	1,088
Early silage	15	89.9	859	2	77.8	60	--	----	----	17	88.5	919
Seed:												
Barley	3	100.5	85	--	----	----	1	100.0	17	4	100.3	100
Wheat	1	93.5	42	1	82.3	11	--	----	----	2	87.9	53
Oats	1	100.0	18	--	----	----	--	----	----	1	100.0	18
Alfalfa	14	83.0	1,113	--	----	----	--	----	----	14	83.0	1,113
Clover	1	100.0	8	--	----	----	--	----	----	1	100.0	8
Corn	7	101.7	351	--	----	----	--	----	----	7	101.7	351
Lettuce	2	125.0	46	--	----	----	--	----	----	2	125.0	46
Onion	3	100.0	84	--	----	----	--	----	----	3	100.0	84
Pea	1	100.0	18	--	----	----	--	----	----	1	100.0	18
Bean	5	84.7	214	--	----	----	--	----	----	5	84.7	214
Vegetables:												
Green beans	3	103.6	48	--	----	----	--	----	----	3	103.6	48
Other beans	2	92.9	145	--	----	----	--	----	----	2	92.9	145
Dry beans	3	85.5	700	1	100.0	80	1	55.6	30	5	82.4	810
Greens, spinach	2	108.5	64	--	----	----	--	----	----	1	108.5	64
Sweet corn	9	86.7	327	--	----	----	--	----	----	9	86.7	372
Dry peas	3	80.0	140	--	----	----	--	----	----	3	80.0	140
Onions	3	93.5	130	--	----	----	--	----	----	3	93.5	130
Potatoes	9	97.8	941	3	97.0	95	26	94.1	3,657	38	9.52	4,693
Sugar beets	14	95.2	1,221	--	----	----	4	80.6	535	18	92.0	1,756
Tree fruits	29	100.1	1,944	--	----	----	--	----	----	29	100.1	1,944
Strawberries	--	----	25	--	----	----	--	----	----	--	----	25
Hops	10	97.0	1,963	--	----	----	--	----	----	10	97.0	1,963
Mint	46	90.5	3,988	--	----	----	--	----	----	46	90.5	3,988
Total harvested acres	353	90.7	21,192	165	61.8	16,145	153	89.5	16,808	671	83.5	57,145

[1] Number reporting yield for this crop.

[2] Reported yields as a percentage of reported normal yields averaged across respondents, using a weighted average by acreage.

[3] Total reported acreage of this crop, excluding unharvested, idled, and set aside.

Table 5 Loss from reduced crop yields in 1977, by crop

Crop	Ada-Canyon counties			Blaine-Lincoln counties			Bingham-Bannock counties			All three areas		
	Acres	Loss	Loss per acre	Acres	Loss	Loss per acre	Acres	Loss	Loss per acre	Acres	Loss	Loss per acre
Alfalfa/Grass hay	2338	$109127	$46.70	7003	$449228	$64.20	4717	$128463	$27.20	14058	$686818	$48.90
Grain hay	98	0	---	165	3600	21.80	112	2700	24.10	375	6300	16.80
Irrigated pasture	1412	16492	11.70	6033	194190	32.20	1057	13500	12.80	8502	224182	26.40
Green chop	18	576	32.00	91	4140	45.50	---	---	---	109	4716	43.30
Wheat	600	17943	29.90	326	22205	68.10	4541	84990	18.70	5467	125138	22.90
Wheat, dryland variety	---	---	---	63	317	5.00	---	---	---	63	317	5.00
Barley, feed	3469	86443	24.90	1258	75813	60.30	1151	24283	21.10	5878	186539	31.70
Barley, malting	136	2069	15.20	---	---	---	650	11880	18.30	786	13949	17.70
Barley, feed, dry variety	50	540	10.80	605	40157	66.40	---	---	---	655	40697	62.10
Oats	233	1566	6.70	399	16860	42.30	168	1080	6.40	800	19506	24.40
Rye	44	0	---	---	---	---	---	---	---	18	0	---
Mixed grain	115	1170	10.20	169	4871	28.80	68	265	3.90	352	6306	17.90
Mixed grain, dry variety	---	---	---	60	5148	85.80	---	---	---	60	5148	85.80
Corn, grain	201	5670	28.20	---	---	---	---	---	---	201	5670	28.20
Corn, grain, early mat.	35	394	11.50	15	0	---	---	---	---	50	394	7.90
Corn, silage	941	44655	46.00	12	984	82.00	105	1405	13.40	1088	47044	43.20
Corn, silage, early mat.	859	17769	20.70	60	2810	46.80	---	---	---	919	20579	22.40
Seed: Barley	83	---	---	---	---	---	17	0	---	100	0	---
Wheat	42	1208	28.80	11	725	65.90	---	---	---	53	1933	36.50
Oats	18	0	---	---	---	---	---	---	---	18	0	---
Alfalfa	1113	211500	190.00	---	---	---	---	---	---	1113	211500	190.00
Clover	8	0	---	---	---	---	---	---	---	8	0	---
Corn	351	16517	47.10	---	---	---	---	---	---	351	16517	47.10
Lettuce	46	0	---	---	---	---	---	---	---	46	0	---
Onion	84	0	---	---	---	---	---	---	---	84	0	---
Pea	18	0	---	---	---	---	---	---	---	18	0	---
Lima bean	66	5600	84.80	---	---	---	---	---	---	66	5600	84.80
Pinto beans	22	2310	105.00	---	---	---	---	---	---	22	2310	105.00
Garden variety bean	126	0	---	---	---	---	---	---	---	126	0	---
Green beans	48	490	10.20	---	---	---	---	---	---	48	490	10.20
Kidney beans	45	0	---	---	---	---	---	---	---	45	0	---
Lima beans	100	6500	65.00	---	---	---	---	---	---	100	6500	65.00
Dry commercial beans	700	45130	64.50	80	0	---	30	4920	164.00	810	50050	61.80
Greens/spinach	64	0	---	---	---	---	---	---	---	64	0	---
Sweet corn	327	11070	33.90	---	---	---	---	---	---	327	11070	33.90
Dry peas	140	9520	68.00	---	---	---	---	---	---	140	9520	68.00
Onions	130	2500	19.20	---	---	---	---	---	---	130	2500	19.20
Potatoes	941	38625	41.00	95	3200	33.70	3657	159390	43.60	1693	201215	42.90
Sugar beets	1221	44299	36.30	---	---	---	535	44119	82.50	1756	88418	50.40
Tree fruits	1944	25000	12.90	---	---	---	---	---	---	1944	25000	12.90
Strawberries	25	0	---	---	---	---	---	---	---	25	0	---
Hops	1963	44320	22.60	---	---	---	---	---	---	1963	44320	22.60
Mint	3988	43269	108.50	---	---	---	---	---	---	3988	432699	108.50
Total irrigated cropland	24192	1201702	49.70	16445	824308	50.10	16808	476995	28.40	57445	2503905	43.60
Dryland barley	---	---	---	495	3593	7.30	---	---	---	495	3593	7.30
Dryland pasture	67	90	1.30	32356	33021	1.00	10266	2220	.20	42683	35331	.50
Total dryland	67	90	1.30	32851	36614	1.10	10260	2220	.20	43178	38924	.90
Unharvested	50	---	---	1392	---	---	133	---	---	1575	---	---
Idled	425	---	---	1109	---	---	10	---	---	1544	---	---
Set aside	---	---	---	---	---	---	10	---	---	10	---	---
Waste	431	---	---	3920	---	---	522	---	---	4873	---	---
Total all land	25165	1201792		55717	860922		27743	479215		108625	2541929	

at the beginning of the planting season, while the fourth change is made later in the season and, like the reduced crop yields discussed earlier, may or may not have been only a consequence of the farmers actions.

Table 6 shows the number and percent of irrigated acres in the four acreage change categories by area. Farmers in the three study areas made acreage adjustments based on the drought's severity and the available options. The acreage devoted to crop variety changes and crop changes indicate not only the drought's actual severity, but the farmers' early perception of how serious the drought would be as well as the available alternative crops and varieties. Idled acreage shows an even more severe adjustment, or a lack of alternative crop varieties or alternative crops for that area. Nealy 20 percent of the cropland in Blaine-Lincoln counties study area was affected by acreage adjustments, indicating the severity of the drought.

Table 6. Drought-related acreage changes in 1977, by area

	Ada-Canyon		Blaine-Lincoln		Bingham-Bannock		All three areas	
	Acres	% of total acres[2/]	Acres	% of total acres[2/]	Acres	% of total acres[2/]	Acres	% of total acres[2/]
Variety change	652	2.6	890	4.6	0	0	1,542	2.5
Crop change	1,111	4.5	465	2.4	287	1.7	1,863	3.1
Idled acreage	390[1/]	1.6	1,109	5.7	10	.06	1,509	2.5
Unharvested acreage	50	0.2	1,392	7.2	153	.8	1,575	2.6
Total	2,203	8.9	3,856	19.9	430	2.6	6,489	10.7

[1/] Excludes 35 acres that were idled, but not drought related.

[2/] Percentage of irrigated and dryland cropland, excludes waste and dryland pasture.

Table 7 gives the four acreage changes by crop for the three study areas, as well as the "change in planted acres" which is the sum of the crop and variety changes, and the idled acreage. The unharvested acreage is subtracted from the "change in planted acres" to get the "change in harvested acres" which is the net change resulting from drought. For all adjustments shown in

Table 7 Acreage Changes Resulting from Changes of Crop or Variety, and from Idle land and Crops Not Harvested, 1977.

	Ada-Canyon Counties						Blaine-Lincoln Counties						Bingham-Bannock Counties						All Three Areas				
	Change Crop	Change Variety	Idle	Change Planted Acres	Not Harvest	Change Harvest Acres	Change Crop	Change Variety	Idle	Change Planted Acres	Not Harvest	Change Harvest Acres	Change Crop	Change Variety	Idle	Change Planted Acres	Not Harvest	Change Harvest Acres	Change Crop	Change Variety	Idle	Change Planted Acres	Net Harvest
Hay: Alfalfa	43			43		43	-25		-43	-68	-649	-717	50			50		50	68		-43	25	-[illegible]
Other	110			110	-9	101	25			25		25							135			135	-[illegible]
Green Chop	12			12		12	111			111	-50	61							123			123	-[illegible]
Wheat: Spring	107			107	-10	97	-25	55		30		30							82	55		137	-[illegible]
Winter	-6			-6	-8	-14		-55		-47		-47							2	-55		-53	-[illegible]
Unspecified	-7		-14	-21		-21	-80		-180	-260		-260	-17			-17	-13	-30	-104		-194	-298	-[illegible]
Barley: Feed	260	-50	-140	70		70	206	-700	-235	-729	-455	-1184	127			127	-30	97	393	-750	-375	-532	-[illegible]
Dryland Var.		50		50		50	15	700		715	-55	660					-70	-70	15	750		765	-[illegible]
Oats	45		-10	35		35			-43	-43	-40	-83			-10	-10	-20	-30	45		-63	-18	-[illegible]
Rye: Dryland Var.								60		60		60								60		60	
Mixed Grain							-115	-60	-317	-492	-25	-517							-115	-60	-317	-492	-25
Corn: Grain	-28	-35		-63		-63													-28	-35		-63	
Early Grain	9	35		44		44													9	35		44	
Silage	-228	-567	-97	-892		-892	-55	-60	-186	-301		-301							-283	-627	-283	-1193	
Early Silage	8	567		575		575	15	60		75		75							23	627		650	
Seed: Alfalfa	-29			-29		-29													-29			-29	
Corn	20		-17	3		3													20		-17	3	
Lettuce	10			10		10													10			10	
Pea	18			18		18													18			18	
Bean	-81			-81		-81													-81			-81	
Beans	-289			-289		-289	-40			-40		-40							-329			-329	
Sweet Corn	-4			-4	-20	-24													-4			-4	-20
Dry Peas	140			140		140													140			140	
Onions	-25			-25		-25													-25			-25	
Potatoes	-10		-40	-50		-50	-40			-40		-40	-160			-160		-160	-210		-40	-250	
Sugar Beets	-46			-46		-46													-46			-46	
Mint	-77		-72	-149	-3	-152													-77		-72	-149	-3
Gross Acres Affected	1111	652	390	2153	50	2203	465	875	1004	2482	1274	3756	287	-	10	297	133	430	1863	1527	1401	4932	1727
Net Acres Changed	0	0	-390	-390	-50	-440	0	0	-1004	-1004	-1274	-2278	0	0	-10	-10	-133	-143	0	0	-1401	-1404	-1457
Normal Irrigated Land				24,667[1]						18,723						16,951						60,341	

[1] Total of harvested acreage, idle land and acreage not harvested.

positive numbers indicate an increase and negative numbers indicate a decrease. For example using feed barley in the Ada-Canyon county study area, 260 more acres of barley were planted as shown under "change crop". Fifty acres that would have been in feed barley were switched to a dryland variety and another 140 acres were idled. When this 190 acres is subtracted from the 260 acres, a net increase in planted acres of 70 acres is left. Since no feed barley was reported as unharvested, the net change in harvested feed barley was 70 acres.

Acreage adjustments to reduced water usage resulted in a cost, or more appropriately, an income penalty. The loss in income was calculated as the difference between the net income of the crop foregone and the crop actually grown. This accounts for the difference in both revenues and costs. Table 8 summarizes crop income loss for the acreage adjustments, along with income loss from reduced crop yields. Reduced crop yields accounted for the largest share of economic loss in all three study areas, ranging from a low of 68.4 percent in Blaine-Lincoln counties to a high of 88.6 percent in Bingham-Bannock counties. Idled and unharvested acreage (options of last resort) accounted for slightly over 25 percent of the crop loss in Blaine-Loncoln counties while accounting for only 7.5 percent in Ada-Canyon counties and 2.1 percent in Bingham-Bannock counties. This follows the severe, moderate and slight impact anticipated when the three respective study areas were chosen.

Early Season Acreage Adjustments - 1977

A breakdown of the early season strategies: variety change, crop change, and idled acreage are shown in Table 9-11 for farmers interviewed in Bingham-Bannock, Ada-Canyon, and Blaine-Lincoln counties respectively. The acreage adjustment by crop is given, along with the percentage this is of the normal acreage for that crop shown in parenthesis. The acres under "normal planting" indicate how many acres of each reported crop would have been grown in absence of the drought. Acreage figures under "unadjusted" were those actually planted, again with the percentage of normal acreage in parenthesis. For example using feed barley in Ada-Canyon counties (Table 10), 50 acres (3%)was planted to a variety not normally grown in that area, but which would perform better under reduced moisture conditions. Another 175 acres (5%) were switched to different crops and 140 acres (4%) were idled, both in an effort

Table 8. Summary of crop income loss in 1977

Factor	Ada-Canyon counties			Blaine-Lincoln counties			Bingham-Bannock counties			All three areas		
	Loss	% of total loss	Loss per irrigated acre[1/]	Loss	% of total loss	Loss per irrigated acre[1/]	Loss	% of total loss	Loss per irrigated acre[1/]	Loss	% of total loss	Loss per irrigated acre[1/]
Reduced crop yields	$1,201,792	75.6	48.72	$860,922	68.4	41.03	$479,215	88.6	28.14	$2,541,929	75.0	42.77
Variety changes	33,200	2.1	1.35	22,280	1.8	1.19	0	0	0	55,480	1.6	0.92
Crop changes	235,507	14.8	9.55	51,043	4.1	2.73	50,085	9.3	2.95	336,635	10.0	5.58
Idled cropland	105,175	6.6	4.26	91,789	7.3	4.90	754	0.1	0.04	197,718	5.8	3.17
Unharvested cropland	14,897	0.9	0.60	232,344	18.4	12.41	10,679	2.0	0.63	257,920	7.6	4.18
Total	$1,590,571	100.0	64.48	$1,258,378	100.0	64.80	$540,733	100.0	31.57	$3,389,682	100.0	55.33

[1/] Includes the total irrigated acreage for each area, not just the affected acreage.

Table 9 Early season strategies for Bingham-Bannock counties, showing acreage and percentage of normal planted acreage

Crop	Change to new variety	Change to new crop	Idled	Unadjusted	Normal planting
Alfalfa/grass hay				4,667 (100)	4,667
Grain hay				112 (100)	112
Irrigated pasture				1,057 (100)	1,057
Wheat		127 (2.8)		4,444 (97.2)	4,571
Barley, feed				1,054 (100)	1,054
Barley, malting				650 (100)	650
Oats			10 (5)	188 (95)	198
Mixed grain				68 (100)	68
Corn silage				105 (100)	105
Seed barley				17 (100)	17
Dry beans				30 (100)	30
Potatoes		160 (4)		3,657 (96)	3,817
Sugar beets				535 (100)	535
Total		287 (1.7)	10 (.3)	16,584 (98)	16,881

to reduce water needs. These three types of changes account for 11 percent of the normal planted acreage for feed barley, with the remaining 89 percent planted as normal. Tables 9-11 help illustrate what changes were made by farmers as well as their relative importance.

Table 9 shows the prevalent strategy in the Bingham-Bannock survey area was to plant their normal crops, with 98 percent of the acreage unadjusted except for possible input adjustments. Table 10 shows that farmers surveyed in Ada-Canyon counties made a larger use of early adjustments. In absolute numbers more acreage from lower value crops (grain and forage) was adjusted in response to drought, but the percentage acreage adjustment for higher value crops was often greater. With few alternative crops, Table 11 shows farmers in Blaine-Lincoln counties switching varieties of grain and to a lesser degree switching varieties of corn, and also idling cropland. Six percent of the normal planted cropland was left idle, indicating the stronger response to drought needed in this area.

Crop Income Loss Summary - 1978

Drought impacts were not limited to 1977 alone. Table 12 summarizes the crop loss data: reduced yields, variety changes, crop changes, idled acreage, and unharvested acreage for 1978 by area. Carry-over drought effects caused some reduced yields for farmers sampled in all three study areas, although these were minor for Bingham-Bannock and Ada-Canyon counties. Only in severely impacted Blaine-Lincoln counties were reduced yields of significance, and it was the only area of the three where acreage adjustments were reported in 1978.

Comparing the crop income loss for 1977 and 1978 shows a striking difference, from a total crop loss of nearly $3.4 million in 1977 to just under $200,000 in 1978.

Impacts on Livestock

The main focus of this study was the effects of drought on irrigated crop production. Since many of the farms sampled had livestock with crops grown

Table 10 Early season strategies for Ada-Canyon counties, showing acreage and percentage of normal planted acreage

Crop	Change to new variety	Change to new crop	Idled	Unadjusted	Normal planting
Alfalfa/ grass hay		12 (1)		2280 (99)	2292
Grain hay					0
Irr. pasture				1412(100)	1412
Green chop				6(100)	6
Wheat		38 (7)	14 (3)	486 (90)	538
Barley, feed	50 (3)	175 (5)	140 (4)	2859 (89)	3224
Barley, malting				136(100)	136
Oats			10 (5)	188 (95)	198
Rye				44(100)	44
Mixed grain				115(100)	115
Corn, grain	35 (15)	28 (12)		173 (73)	236
Corn, silage	567 (27)	257 (13)	97 (5)	1116 (55)	2037
Seed:					
Barley				35(100)	35
Wheat				42(100)	42
Oats				18(100)	18
Alfalfa		29 (3)		1113 (97)	1142
Clover				8(100)	8
Corn			17 (5)	314 (95)	331
Lettuce				36(100)	36
Onion				84(100)	84
Pea					0
Lima beans		30 (32)		66 (68)	96
Pinto beans		31 (58)		22 (42)	53
Garden var. beans		20 (14)		126 (86)	146
Green beans				48(100)	48
Kidney beans				45(100)	45
Lima beans		75 (43)		100 (57)	175
Dry commercial beans		214 (23)		700 (77)	914
Greens/spinach				64(100)	64
Sweet corn		44 (14)		263 (86)	307
Dry peas					0
Onions		25 (16)		130 (84)	155
Potatoes		10 (1)	40 (4)	941 (95)	991
Sugar beets		46 (4)		1221 (96)	1267
Tree fruits				1944(100)	1944
Strawberries				25(100)	25
Hops				1963(100)	1963
Mint		77 (2)	72 (2)	3991 (96)	4140
Total	652 (2.7)	1111 (4.6)	390 (1.6)	22,114 (91)	24,267

Table 11 Early season strategies for Blaine-Lincoln counties, showing acreage and percentage of normal planted acreage

Crop	Change to new variety	Change to new crop	Idled	Unadjusted	Normal planting
Alfalfa/grass hay		50 (.6)	43 (.4)	7721 (99)	7,814
Grain hay				140(100)	140
Irrigated pasture				6033(100)	6033
Green chop				30(100)	30
Wheat	55 (9)	105 (17)	180 (30)	263 (44)	603
Barley, feed	700 (29)	60 (2.5)	235 (9.6)	1447 (59)	2442
Oats			43 (9)	439 (91)	482
Mixed grain	60 (9)	115 (17)	317 (46)	194 (28)	686
Corn, grain	15(100)				15
Corn, silage	60 (19)	55 (18)	186 (59)	12 (4)	313
Wheat seed				11(100)	11
Dry commercial beans		40 (33)		80 (67)	120
Potatoes		40 (30)		95 (70)	135
Total	890 (5)	465 (2)	1004 (6)	16,465 (87)	18,824

Table 12 Summary of crop income losses for 1978

Factor	Ada-Canyon counties			Blaine-Lincoln counties			Bingham-Bannock counties			All three areas		
	Loss	% of total loss	Loss per irrigated acre1/	Loss	% of total loss	Loss per irrigated acre1/	Loss	% of total loss	Loss per irrigated acre1/	Loss	% of total loss	Loss per irrigated acre1/
Reduced crop yields	47,724	96.9	1.95	110,615	76.4	6.02	5,140	86.5	0.29	163,479	81.7	2.71
Variety changes	0	0	0	0	0	0	0	0	0	0	0	0
Crop changes	0	0	0	32,208	22.2	1.75	0	0	0	32,208	16.1	0.53
Idled cropland	0	0	0	845	0.5	0.05	0	0	0	845	0.4	0.01
Unharvested cropland	1,504	3.1	0.06	1,140	0.7	0.06	804	13.5	0.05	3,448	1.7	0.06
Total	49,228	100.0	2.02	144,808	100.0	7.88	5,944	100.0	0.34	199,980	100.0	3.32

1/ Includes the total irrigated acreage for each area, not just the affected acreage.

primarily for livestock feed, drought impact on the livestock enterprise was also considered important. This was especially true in Blaine-Lincoln counties.

Impacts on livestock (cattle and sheep) and dairy operations are placed in three categories. First, reduced feed production may force the farmer to rent additional pasture or to purchase additional hay. Second, it may not be physically possible or economically feasible to replace lost feed, requiring earlier than normal marketing of calves and lambs and at lighter weights. Even when not sold early, reduced quantity or quality of feed may lower the selling weights. Third, when feed is not replaced, breeding stock must be sold. While an immediate gain is realized from selling additional animals, reduced future production and income result until brood stock levels are rebuilt.

Table 13 presents the economic impact of drought on livestock enterprises for the farmers interviewed in the three study areas. Substantial losses in most categories in Blaine-Lincoln counties indicates the importance of livestock in that area as well as the large drought impact. Drought's impact on livestock cannot simply be added to impacts on crops to get a total impact. Part of the drought impact on livestock is actually included on the crop impact where the effect occurred first. Because of this overlap and the inability to separate these, the impacts were calculated separately and adding them together would result in a double counting.

Water Transfers

Acreage changes to reduce water requirements were not the only adjustments made. Water was purchased and sold as farmers sought to adjust to the general water shortage. Some farmers or water organizations with older, more secure water rights had water they were willing to sell, while others with less secure rights and/or a high investment in a perennial crop were willing to buy additional water.

Table 14 summarizes water transfers reported by farmers in the three study areas, giving the number of farmers reporting a transfer, the average cost per acre foot or miners inch, and the average total payment. The greatest water transfer activity was reported by farmers in Ada-Canyon counties where a water

Table 13 Effects of drought on livestock enterprises

Drought effect	Ada Canyon counties		Blaine Lincoln counties		Bingham Bannock counties		All three areas	
	#[1]	Total loss[2]	#	Total loss	#	Total loss	#	Total loss
Beef								
Light cattle loss 77	2	1,560	18	5,998,120	9	843,922	29	6,843,602
Additional breeding stock sold 77	3	370,592	17	526,986	3	483,864	23	1,381,442
Light cattle loss 78	0	---	2	393,335	2	1,153,791	4	1,547,126
Additional breeding stock bought 78	1	630	6	109,495	3	37,560	10	147,685
Additional pasture cost 77	0	---	7	36,320	2	2,400	9	38,720
Additional feed cost 77	4	2,455	15	144,191	6	21,635	25	168,281
Additional pasture cost 78	0	---	2	3,100	0	---	2	3,100
Additional feed cost 78	0	---	6	38,330	0	---	6	38,330
Sheep								
Light lamb loss 77	0	---	3	12,670	0	---	3	12,670
Additional ewes sold 77	0	---	1	2,100	0	---	1	2,100
Additional feed cost 77	0	---	2	13,780	0	---	2	13,780
Dairy								
Additional cows culled 77	2	4,343	7	202,425	0	---	9	206,768
Additional cows purchased 78	1	1,500	3	39,700	0	---	9	41,200
Additional pasture cost 77	0	---	1	1,100	0	---	1	1,100
Additional feed cost 77	7	65,260	13	163,501	2	2,600	22	231,361
Additional feed cost 78	0	---	2	19,330	0	---	2	19,330

[1] Number reporting loss for this item.

Table 14 Significance of water transfer

	Ada-Canyon counties		Blaine-Lincoln counties		Bingham-Bannock counties		All three areas	
	#[1]	av[2]	#[1]	av[2]	#[1]	av[2]	#[1]	av[2]
Water acquired								
Stored water (acre feet)	18	167.6	2	77.0			20	158.5
Flow water (miners inches)	3	74.3	5	49.4			8	58.7
Cost ($)	20	5910.0	8	413.0	1	120.0	29	4194.0
Water transferred to other users								
Stored water (acre feet)	6	76.7					6	76.7
Flow water (miners inches)	3	102.3	1	100.0	1	115.0	5	104.4
Revenue ($)	9	822.0	1	0.0			10	740.0

[1] Number of farmers reporting this item.

[2] Average flow/volume/cost for those reporting.

delivery system compatable to transfers existed. While one might expect more transfer activity in severely impacted Blaine-Lincoln counties than shown by Table 14, the lack of available water to transfer in spite of the severe drought conditions kept the number down.

Labor Adjustments

Because many adjustments made by farmers to drought required more labor or changes in labor allocation, a farmer had a choice of using more of his own or family labor, or hiring additional labor. Table 15 summarizes part of the labor adjustments made by farmers in the three study areas.

The farmer questionnaire dealt only with additional irrigation labor, so the overall impact on total labor requirements is unclear. Labor savings occurred when land was idled and even when more labor was used, it may have been only for part of the irrigation season. This did occur in severely impacted Blaine-Lincoln counties study area where additional labor was used, but only until water ran out. Overall, less total labor was used in some cases.

Table 15 Impact of drought on labor requirements

Impact	Ada-Canyon counties		Blaine-Lincoln counties		Bingham-Bannock counties		All three areas	
	#[1/]	Amount[2/]	#	Amount	#	Amount	#	Amount
Percentage using more irrigation labor	49	70.0%	17	39.5%	19	50.0%	85	56.3%
Percentage hiring extra irrigation labor	12	17.1%	6	14.0%	6	15.8%	24	15.9%
Average extra hours hired labor	10	1235 hr	6	686 hr	4	340 hr	20	891 hr
Average cost of extra hired labor	11	$3983	6	$1847	5	$1440	22	$2823
Percentage using more family irrigation labor	40	57.1%	9	20.9%	12	31.6%	61	40.4%
Average extra hours family labor	28	483 hr	3	533 hr	7	373 hr	38	467 hr
Percentage using greater part of family labor for irrigation	36	51.4%	14	32.6%	14	36.8%	64	42.4%
Average hours family labor switched to irrigation	24	342 hr	10	413 hr	8	406 hr	42	371 hr

[1/] Number reporting this item.

[2/] Percent/amount/value reported.

When water is plentiful, labor to improve water management is expensive relative to the value of the water. When water is scarce, as in 1977, the incentive exists to use more hired labor because the value of the water is higher relative to the cost of labor even though the price of water remains unchanged. Farmers surveyed in moderately impacted Ada-Canyon counties made a greater use of this adjustment than farmers interviewed in either of the other areas with almost twice the additional hired labor of severely impacted Blaine-Lincoln and nearly four times that of mildly impacted Bingham-Bannock.

Summary

While substantial direct and indirect economic impacts occurred during 1977, they were not as severe as the physical water shortage would suggest. This smaller than expected impact resulted in part because of the slack that exists in most water systems in Idaho, a consequence of the administration of the prior appropriation doctrine on which Idaho's Water Law is based. Another important reason for the reduced impact came from effective adjustments made at both the farm and water organization level. The relative importance of each reason is not yet clear because information necessary to make this type of separation is not yet available. Determining precise crop water-yield relationships is one prerequisite for any effort in this area.

It is not possible in the space allowed here to present all the information obtained from farmers participating in the study of the 1977 drought. Only the more important summaries are presented. If you have any questions on this information or on other information we gathered but did not present, contact one of the individuals listed below. Once again we would like to express our appreciation to all those who participated in this study.

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